SERVICE MANUAL 4587

PN-150T TIME ELEMENT RELAY
WITH 2F CONTACTS

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UNION SWITCH & SIGNAL DIVISION
AMERICAN STANDARD INC. / SWISSVALE, PA 15218

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I. GENERAL

This manual is supplied as a guide for operation and maintenance of the PN-150T relay. The manual covers PN-150T relays with suffix numbers of 001 to 007, 201 to 208, and 301 to 308. Table 1 lists the part numbers of the PN-150T's covered by this manual and the corresponding voltage rating, and time range of each.

TABLE 1

PN-150T RELAYS PART NUMBER, VOLTAGE, AND TIME RANGE

000 Series	200 Series	300-Series	Volts	Time Range
N322523-001	N322523-201	N322523-301	10	3-30 sec.
N322523-002	N322523-202	N322523-302	12	3-30 sec.
N322523-003	N322523-203	N322523-303	16	3-30 sec.
N322523-004	N322523-204	N322523-304	10	1/2-5 min.
N322523-005	N322523-205	N322523-305	12	1/2-5 min.
N322523-006	N322523-206	N322523-306	16	1/2-5 min.
N322523-007	N322523-207	N322523-307	10	1-10 min.
	N322523-208	N322523-308	12	1-10 min.

Some of the 001 to 007 suffix series relays have "C" terminals on the contact block. The 200 suffix series relays contain redesigned electronic delay units. The 300 suffix series relays contain delay units with improvements to further increase reliability, for greater reliability. Relays N322523-803 and N322523-806 are physically equivalent to N322523-203 and N322523-206 (respectively); but the former have LEXAN* covers. All 300 suffix series relays have LEXAN* covers.

II. DESCRIPTION

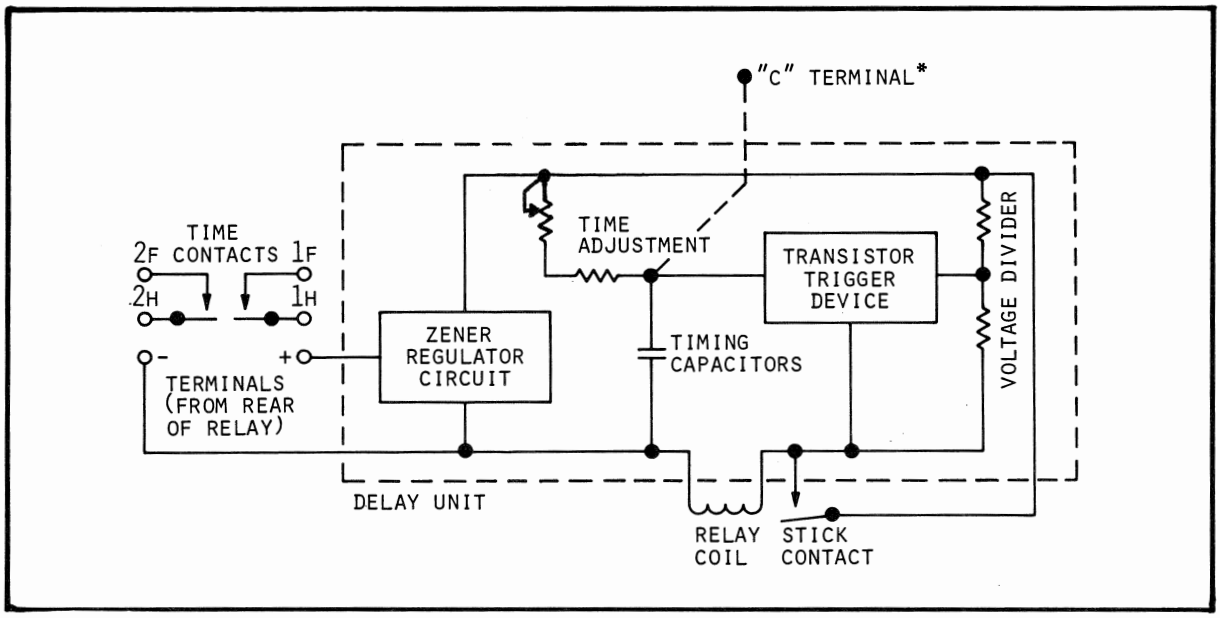
The PN-150T relay is a DC, plug-in, time element relay, and has two front or time contacts for external connection. It is basically a PN-150B relay with an internal electronic delay unit to determine the relay pick-up time. The PN-150T relay is furnished for 10, 12, or 16 volt operation. The pick-up time is adjustable from 3 to 30 seconds for the 30 second relay, .5 to 5 minutes for the 5 minute relay, and 1 to 10 minutes for the ten minute relay. The release time is fixed at 0.5 second for all relays. The power consumption varies from 0.5 watts to 2.5 watts depending on the input voltage. The PN-150T has two standard silver heel contacts and two silver impregnated carbon front contacts rated at 4 amps and up to 30 VDC or 175 VAC.

* Trademark of General Electric

TABLE II

TEST VALUES

Rated Volts	Test Voltage Low	Test Voltage High	Min. F.D.A. Shop	Min. F.D.A. Service
10	8.5	12.5	1.5	1.0
12	10.0	15.0	1.8	1.2
16	13.0	20.0	2.4	1.6



* Used only on some 001-007 suffix series relays

Figure 1. Basic Circuit For All Suffix Series Relays

III. INSTALLATION AND SERVICE RECOMMENDATIONS

The plastic indexing plate furnished with the relay should be applied to the mounting base for the relay using the screws provided. To adjust the time interval, remove the plug screw from the front of the relay and turn the internal screw with a small screwdriver. Clockwise rotation will increase the time.

The 200 suffix and 300 suffix relays have a timing dial, located on the front of the delay unit that indicates the delay time; that is, the time starting at the application of power to the relay's control circuit and ending with the heels making contact with fronts. Accuracy of the timing dial is ±10%. Accurate time settings are made using a stop watch. A red light on the front of the delay unit starts to glow the moment power is applied to the relay's control circuit, indicating the timing cycle has started. Closure between front and heel contacts indicates the end of the timing cycle. The red indicator light will continue to glow after closure on front contacts, and will only be extinguished when power is removed from the relay's control circuit.

It is recommended that the relay be checked at regular intervals for proper pick-up time, and at longer intervals to meet the requirements given in Section VIII.

The 200 suffix and 300 suffix series relays will operate from 85% to 125% of rated voltage. The suffix 000 series relays can be energized at up to 150% of rated voltage. Voltages in excess of these amounts should be avoided as they cause excessive power dissipation that can damage the components within the delay units.

IV. RELAY OPERATION

The basic circuit for all suffix series relays is shown in Figure 1. Constant voltage of the zener regulator charges a solid tantalum capacitor bank through an adjustable resistor the charging time being proportional to the resistance setting. When the capacitors have charged to a reference voltage determined by the divider resistors, a transistor combination is triggered, causing the capacitors to discharge through the relay coil. A resulting pulse picks up the relay which holds itself up over an internal front stick contact until the supply voltage is removed.

V. RELAY ADJUSTMENTS

The relay armature is set at the factory to a parallel air gap of 0.23 inch. The adjustable back stop screw in the horizontal extension of the permanent magnet assembly is adjusted to provide an air gap of .016 inch between the armature and the extension. The extension itself is adjusted to provide an armature stroke of 0.110 inch at the main (non-adjustable) stop pin.

All checks of contact adjustment should be made with the relay in its normal, upright position. The "Time" (left and right) contacts should be adjusted to be barely open with the armature held up against a .031 inch spacer at the main stop pin. With a .029 inch spacer, these contacts should be closed. The center contact should be adjusted to be barely open with a .039 inch spacer at the main stop pin. With a .037 inch spacer, this contact should be closed. Contacts are adjusted by bending slightly at the base of the front contact members.

The flat "bias" spring, which presses upward against the bottom of the contact driving member, should be adjusted as called for in Section VII. More detailed information on the cleaning and adjustment of contacts is given in Service Manual 4551, entitled, "PN-150B Biased Neutral Plug-In Line Relay", and Service Manual 4560, "Instructions for Cleaning Relay Contacts".

VI. DELAY UNIT DESCRIPTION AND TESTING

Delay units supplied with the suffix "000" series relays were selected on the basis of supply voltage and time range. In the suffix "200" and "300" series the delay unit is selected on the basis of time only, with the relay coil being chosen on the bias of supply voltage. (See Table III for a complete listing of up to date delay units used on the 300 suffix series and relay coil used on the 200 and 300 suffix series. The delay units used on the 000 and 200 series are no longer available. For updating relays see Section IX.

CAUTION

> It is important that the proper coil be used with the suffix "200" and "300" series delay units. Ohterwise, complete destruction of the delay unit may occur.

The magnetic shield can be slipped off the delay unit by removing two small screws at the front end. Connect a 0 to 10 VDC or 0 to 15 VDC voltmeter, having a resistance of at least 10,000 ohms per volt, from the minus terminal of the relay (see

Figure 1) to the two potentiometer terminals which are tied together. It will be convenient to set the time adjustment at "MAX" for a 30 second relay and "MIN" for a 5 minute and 10 minute relay. Apply rated voltage to the relay. During the pick-up delay period, the voltmeter should read in a range from 7.0 to 8.0 volts. A higher voltage would indicate a condition that could be hazardous. Once the relay has picked up, the voltage can be expected to go to a lower value that has no significance.

The relay pick-up time should be measured at "MAX", then "MIN". It should be observed that the time is adjustable over the full range of 30 to 300 seconds or 3 to 30 seconds, or 1 to 10 minutes. If the relay does not pick up, it may be that the relay is out of calibration at the flat "bias" spring mentioned in Section V. After energizing the relay, apply a slight finger pressure under the armature to hold it in a position with the center, front contact just open. If the delay unit is functioning, the relay can now be expected to pick up at the end of the delay period.

If trouble is traced to the delay unit or the relay coil, it is recommended that the entire relay be returned to our factory for correction. Several of the electronic components are critical and are selected to provide the proper time range and temperature compensation for a particular production delay unit. Therefore, these components should be replaced at the factory.

VII. RELAY CALIBRATION

It is important to hold the pick-up calibration of the relay within specified limits. The calibration is kept high enough that if for any reason the transistors should fire too early, there will not be enough energy stored in the timing capacitor to pick up the relay. On the other hand, the calibration must be kept low enough that the relay will pick up properly under all service conditions.

With the voltmeter connected as described in Section VI, and set for DC rated input voltage, carefully measure the Zener volts toward the end of the delay period. The time should be set a "MAX" of 30 for the 30 second relay and "MIN" or 1 for the 5 minute or 10 minute relays. Now energize the relay again, but this time reduce the supply voltage until the Zener voltage at the end of the time interval is 92% of the Zener voltage measured at rated input (See Figure 3). The relay should pick up. Now energize the relay again, adjusting the input until the Zener voltage is 88% of that at rated input. The relay should not pick up.

The pick-up calibration is adjusted by slightly bending the support member of the flat "bias" spring which presses upward against the bottom of the contact driving member.

When proper pick-up calibration has been obtained, the relay should be picked up at the "High" test voltage given in Table II, then the supply voltage gradually reduced until the armature drops away. The armature should go to its fully released position at not less than the voltage given in Table II under "Min. Shop F.D.". When properly adjusted and with the relay deenergized, a force of at least 50 grams should be required at the bottom of the contact driving member to lift the armature clear of its full-release position. The force at the same point to cause center contact to just make, should be at least 35 grams.

As a final test, check that the relay will pick up properly at the "Low" test voltage given in Table II.

VIII SERVICE TESTS

The relay in service should be checked at regular intervals of perhaps six months, for proper pick-up time. If appreciable wear is observed at the front contacts, the release calibration of the relay should be measured. Starting with the relay picked up and at full stroke, the supply voltage is gradually decreased until the armature drops away and goes to its fully released position. If the relay is not fully released at the "Service Min. F.D.A." value given in Table II herein, it should be removed from service.

Special precaustions have been taken in the design of the PN-150T relay to insure against any decrease in pick-up calibration. It should therefore be necessary to measure pick up calibration only when the relay is in the signal shop for overhaul. The shopping period for this relay can be at least two years regardless of the frequency of operation in service. At intervals of about two years a field service check should be made of the integrity of the internal Zener diode regulator circuit, as follows:

The only equipment required is a 0 to 10 VDC or 0 to 15 VDC voltmeter having a resistance of at least 10,000 ohms per volt. The instrument should have a test clip on the negative lead and a test prod on the positive lead. The test prod should be sharply pointed, about 1/16 inch in diameter, and at least 2-3/4 inches long. The test clip should be attached to negative supply, preferably at the relay. The prod should be inserted from the rear of the relay rack, through the second uppermost, center, rectangular hole in the relay mounting base. Looking at the relay it will be observed

HOW TO USE FIGURE 3.

1. In the far left vertical column select the appropriate measured zener voltage at the rated input.

2. Using a straight edge follow the line across to where it intersects the 92% diagonal line.

3. From this point of intersection project down to the bottom of the graph and read the new zener voltage which will be arrived at by readjusting the supply voltage.

4. Repeat Step 1.

5. Using the straight edge follow the line across to where it intersects the 88% diagonal line.

6. From this intersection project down to the bottom and read the new zener voltage which will be obtained by once again readjusting the supply voltage (the relay should NOT pick-up).

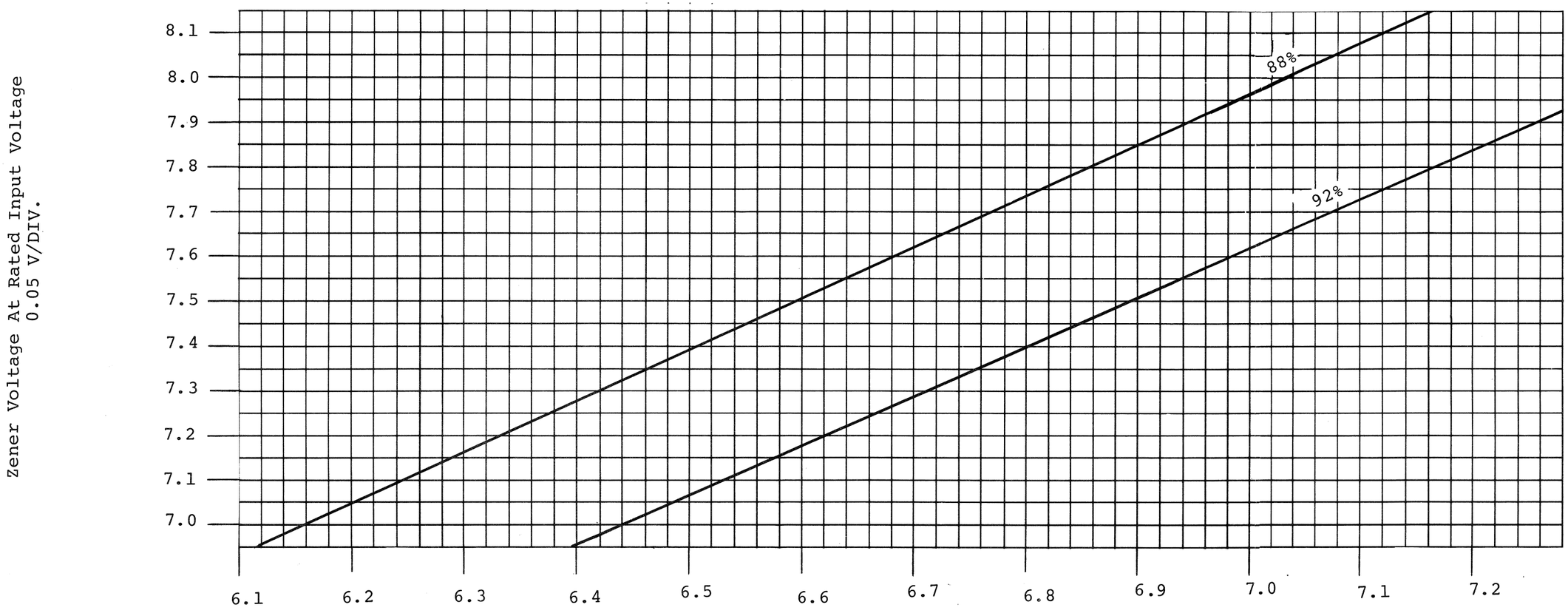


Figure 3. PN-150T Calibration Voltage Conversion Table

that the prod will make contact with the center contact heel member, which has no terminal finger. To make the test, with the relay energized and during its pick-up interval, apply the test prod from the rear of the rack. The voltmeter should read in a range from 7.0 to 9.0 volts for relays with a suffix number of -00X. The voltage should be in the range of 6.8 to 7.8 volts for relays with -200 and -300 suffix numbers. A higher voltage would indicate a conditiion that could be hazardous, and the relay should be removed from service. Once the relay has picked up, the voltage can be expected to go to a lower value that has no significance.

IX. UPDATING THE 001 TO 007 AND 201 TO 208 SUFFIX SERIES RELAY TO 301 TO 308 SUFFIX SERIES RELAYS

The 001 to 007 and 201 to 208 suffix series relays can be updated to correspond with the 301 to 307 series relays that have redesigned assemblies to provide a higher overall reliability. The "301 to "307" series are direct replacements for the former relays of the same basic suffix number; e.g., relays with suffix numbers 001 or 201 are replaced with a suffix number 301 relay.

The delay units for the 301 to 308 series relays are manufactured for three ranges: 3 to 30 seconds, 1/2 to 5 minutes, and 1 to 10 minutes delay units for the 001-007 series were manufactured on a basis of time range and voltage. Now, only the coils determine the voltage rating for the relay.

When ordering replacement delay units for the 001 to 007 series for 12 and 16 volt operation, it is necessary to order the proper coil so that damage to the delay unit does not occur. See Table III for information on ordering items to effect the conversion.

CONVERSION OF 10 VOLT RELAYS (N322523-001, 004, 007, and N322523-201, 204 and 207

The conversion of all 10 volt relays involves changing only the delay unit and recalibrating the relay. The following procedure outlines the necessary steps:

(1) Remove the old delay unit by removing the two screws on the contact block of the relay, and unsoldering the delay unit wires.

NOTE

On some of the suffix 001, 004 and 007 relays, the wire from the delay unit to the "C" terminal must be cut. A wire will not be reconnected to this terminal.

(2) Install the new delay unit and wire it as shown in Figure 4, being careful to get good solder joints. Note that there is no new connection made to the contact finger over which the delay unit sits.

(3) Calibrate the relay as detailed in Section VII of this manual.

(4) Reseal the screw heads in the contact block using cement A41225.

(5) Change first digit of suffix number on nameplate to 2.

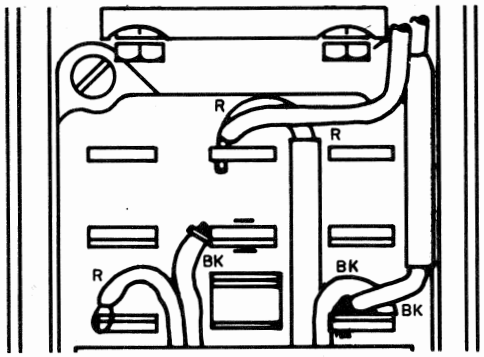


Figure 4. Wiring for Converted 10 Volt Relays

CONVERSION OF 12 AND 16 VOLT RELAYS - (N322523-002, 003, 005, 006

Conversion of the 12 and 16 volt relays involves replacing both the coil and the delay unit. The following procedure outlines the necessary steps:

(1) Remove the coil from the relay by disconnecting the plug-jack connectors.

(2) Remove the red and black coil wires from the relay by unsoldering them from the contact block.

(3) Remove the old delay unit by removing the two screws in the contact block and unsoldering the delay unit wires.

(4) Carefully drill a #6 drill size hole in the relay frame adjacent to the existing hole used for the red and black coil wires. Deburr the hole and round the edges, using a slightly larger drill (1/4" dia.) on both sides.

(5) Place the new coil on the relay frame, routing the red and black leads through the original hole and the two white leads through the new hole. Lay the excess wire in the open area under the coil. Pack the area around the holes with dux seal A41498 to seal the holes.

(6) Route the wires through the relay as shown in Figure 5. (View A and B).

(7) Install the new delay unit and wire as shown in Figure 5. (Make the splice between the red and white wire as neatly as possible so that the insulating tubing will slip easily over the joint. Per view A). Check for bad solder joints and short circuits.

(8) Adjust and calibrate the relay as detailed in Section VII of this manual.

(9) Seal the delay unit screw leads in the contact block, using cement A41225.

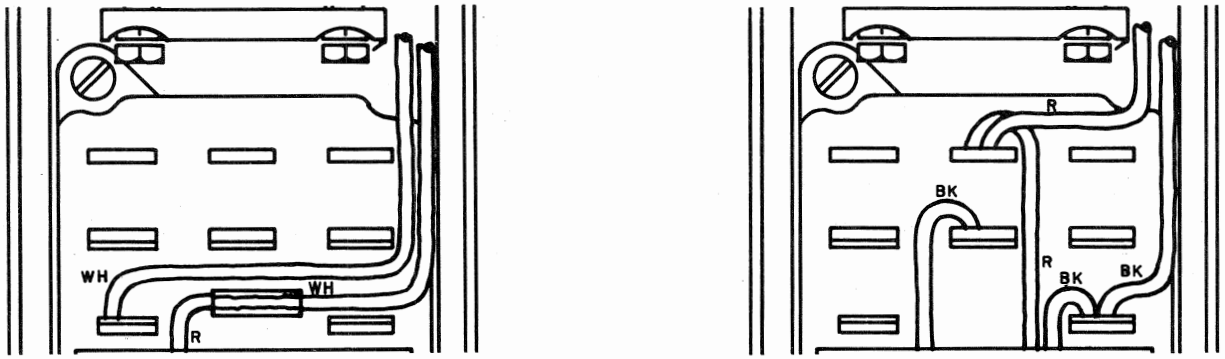
(10) Change first digit of suffix number on nameplate to 2.

NOTE

The indexing pins on the relay do not change since the 301 to 307 suffix relays are direct replacements of the former design.

Conversion Of 12 and 16 Volt Relays - N322523-202, 203, 204, 206, 208, 803 and 806)

For conversion of 12 and 16 volt relays with part numbers N322523-202, 203, 205, 206, 208, 803, and 806, the procedure will be the same as the above, except the coil will not change.



View A. Wiring for White Wires View B. Wiring for Red & Black Wires

Figure 5. Wiring for Converted 12 and 16 Volt Relays

TABLE III

RELAY PART NUMBERS AND CORRESPONDING UP TO DATE COIL AND UP TO DATE DELAY UNIT PART NO.'S

000 Series	200 Series	300 Series	Volts	Time Range	UP TO DATE COIL	UP TO DATE DELAY UNIT
N322523-001	N322523-201	N322523-301	10	3-30 sec.	N399531	N437608-001
N322523-002	N322523-202	N322523-302	12	3-30 sec.	N399531-001	N437608-001
N322523-003	N322523-203	N322523-303	16	3-30 sec.	N399531-002	N437608-001
N322523-004	N322523-204	N322523-304	10	1/2-5 min.	N399531	N437608-002
N322523-005	N322523-205	N322523-305	12	1/2-5 min.	N399531-001	N437608-002
N322523-006	N322523-206	N322523-306	16	1/2-5 min.	N399531-002	N437608-002
N322523-007	N322523-207	N322523-307	10	1-10 min.	N399531	N437608-003
	N322523-208	N322523-308	12	1-10 min.	N399531-001	N437608-003

*The existing coil is not changed on 10 volt relays and need not be purchased unless defective on old relay.

SECTION X
PARTS LIST

STYLE PN-150T TIME ELEMENT RELAY
SUFFIX SERIES 301 to 308
(Reference Figure 7)

ITEM	DESCRIPTION	WABCO Part #
1	Frame	M399420
2	Latch Rod	M388888
3	Speed Nut	J480176
4	Latch	M321728
5	Dowel Pin	J48716
6	Spring	M321861
7	Armature Complete(use Figure 6 & previous parts list for detail parts).	N399421
8	Washer	M291657
9	Screw, #6-32 x 7/16 Fil. Hd. Sh. (Tin Pl.)	J52243
10	Contact Block Complete	N399434-0001
11	Tension Washer	J475104
12	Screw, #8-32 x 7/8 Rd. Hd. Stl. Mach. (Tin Pl.)	J52603
13	Operating Arm	M399422
14	Permanent Magnet Assembly (Magnetized)	M399444
15	Strap	M321853
16	Screw, #8-32 x 1-1/4 Hed. Hd. Stl. (Tin Pl.)	J463078
17	Bronze Screw	M327179
18	Handle	M321821
19	Lockwasher, #10 (Int. Tooth) Ph. Bz. N.P.	J47710
20	Screw, #10-32 x 3/8 Rd. Hd. Brs. N.P.	J51666
21	Coil (See Table III for part No.)	-
22	Screw, 1/4-20 x 3/4 Hex. Cap. Stl. (Tin Pl.)	J50016
23	Screw, #4-40 x 3/16 Rd. Hd. Stl. (Tin Pl.)	J525024
24	Name Plate	M433535
25	Indexing Pin	J487090
26	Gasket	J47081
27	Cover LEXAN	M437058
28	Screw, #6-32 x 5/16 Rd. Hd. Stl. (Tin Pl.)	J525030
29	Washer	M347631
30	Screw	M321747
31	Seal Wire	J43013
32	Seal	J79351
33	Calibration Tag	S3665
34	Screw, #6-32 x 1-1/4 Fil. Hd. Stl. Mach. (Tin Pl.)	J52246

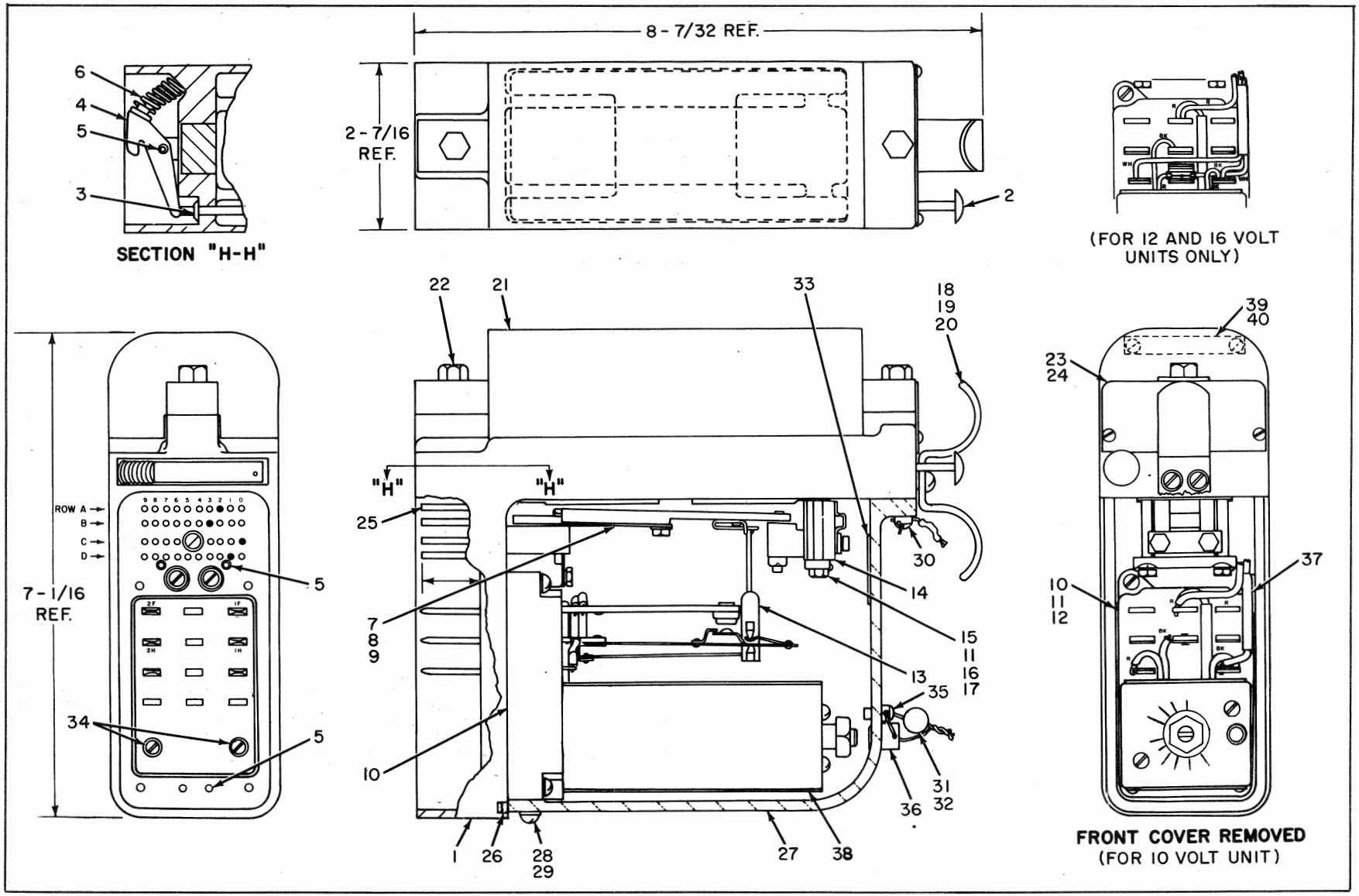


Figure 7. Style PN-150T Time Element Relay, Suffix Series 301 to 308

ITEM	DESCRIPTION	WABCO Part #
35	Screw	M399423
36	Screw Plug	M390716
37	Tubing, #10 Ins. (1-1/8" Long)	A774030
38	Delay Unit (See Table III for part numbers)	
39	Tag	J75828
40	Screw, #4-40 x 3/16 Rd. Hd. Type "F" Self Tapping (Tin Pl.)	J525024

NOTE Parts bag is shipped with each new relay and is tied to the relay handle. The parts bag contains:

(1) Instruction Tag,
(1) Nomenclature Tag,
(1) Indexing Plate
(2) #4-40 x 3/16" Rd. Hd. Stl. (Tin Plate) Screws,
(2) #6-32 x 1-1/4" Fil. Hd. screws.

PARTS LIST

MOUNTING BASE FOR PN-150T TIME ELEMENT RELAYS SUFFIX SERIES 301 TO 308

(Reference Figure 9)

ITEM	DESCRIPTION	WABCO Part #
	Mounting Base, Compl. with Solderless Type Receptacle and Mounting Hardware	N399506 (Note A)
1a	Receptacles, Contact Solderless Type for #10 to #12 Wire	J680181
1b	Receptacles, Contact Solderless Type for #14 to #16 Wire	J680165
1c	Receptacles, Contact Solderless Type for #18 to #20 Wire	J680179
2	Mounting Base Only	N399506-099
3	Screw, #6-32 x 5/8 Fil. St.	
4	Screw, #4-40 x 3/16 (F) Self Tap. Rd. (Tin Pl.)	
5	Washer (Not Shown) (See Note "B")	
6	Screw, 1/4-20 x 1-1/4 Rd. Stl. (Tin Pl.) (Not Shown)	
7	Washer, 1/4 Stl. Lock (M) (Tin Pl.) (Not Shown)	
8	Washer, 1/4 Stl. Plate (Tin Pl.) (Not Shown)	
9	Nut, 1/4 Stl. Hex (Tin Pl.) (Not Shown)	
10	Meter Test Plug	M322965
11	Insulated Test Plug, used for opening any coil or contact circuit and for removing receptacle Springs	J077931
NOTE A:	When "Mounting Base Complete" is ordered a muslin bag of Parts 4-1/8" x 5-1/2" is included in the inner carton with mounting base and instruction Prints. Bag Contains: (2) Tags (4) #4-40 scrs. x 3/16" Rd. Hd. Stl. T.P. (2) Lockwashers 1/4" Steel (tin Plated) (2) Flatwashers 1/4" Hx. Hd. Stl. (Tin Plated)	

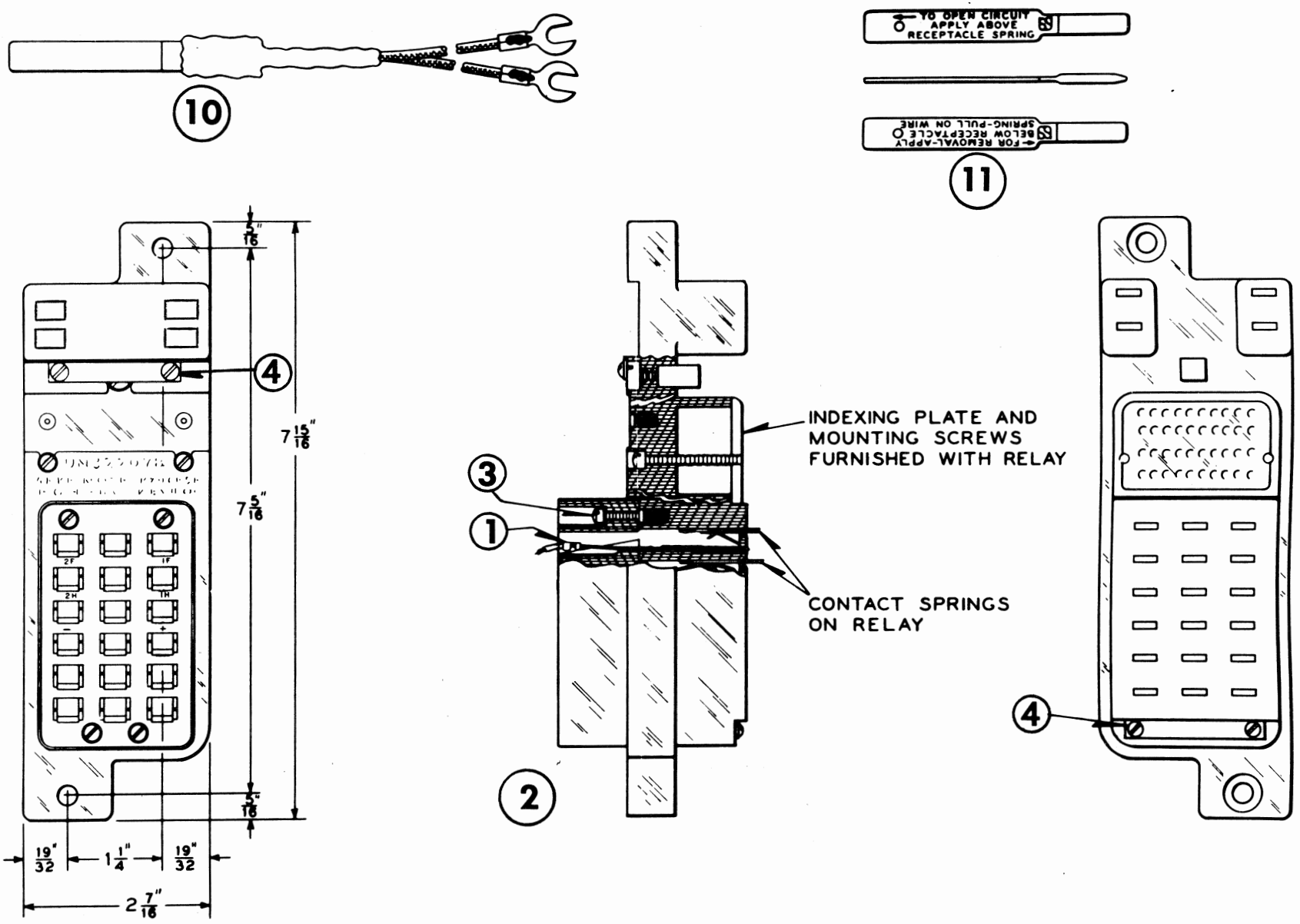


Figure 9. Mounting Base for PN-150T (Time Element Relay, Suffix Series 201 to 207

ITEM	DESCRIPTION	WABCO Part #
	(2) Nuts 1/4" Hx. Hd. Stl. T.P. (2) Washers (2) Screws 1/4" - 20 x 1-1/4" Rd. Hd. Stl. and (Req'.d. Quant.) Contact Receptacles, Solderless J680165 for #14 to #16 wire. If other wire size is used request the proper Part Number as shown in Item 1 when ordering base complete. (i.e. N399506 except using Contact Receptacles, Solderless J680181)	
NOTE B:	Items 5 to 9 inclusive are for attaching mounting base to rack and are contained in the muslin bag shipped with the "Mounting Base Complete" part number.	

PERIODIC MAINTENANCE

All vital relays must be inspected and tested at least every two (2) years. The tests and inspections are to include: pick-up current, drop-away current, timing of slow operating and timing relays, visual inspection of contacts for damage or misalignment, corrosion, or other contamination of parts, loose parts inside of cover, broken seal, and cracked or broken cover.

All vital relays installed in locomotive or car-carried equipment are to be inspected and tested at least every two (2) years as above. In addition, every four (4) years the relays are to be removed from service and adjusted, repaired and tested.

Relays not passing the above stated tests and inspections must be replaced and not returned to service until the operating characteristics and conditions are in accordance with US&S specifications.

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